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Description of six new species and two new infraspecific taxa of Lejeuneaceae (Marchantiophyta) from India

Sushil Kumar Singh✉

Botanical Survey of India, Eastern Regional Centre, Shillong - 793003, India
✉Corresponding author: sksbsinc@rediffmail.com

भारत से लेज्युनिऐसी (मार्केन्शियोफाइटा) कुल की छः नई जातियों एवं दो नई अंर्तजातियों का प्रलेखन

सुशील कुमार सिंह

सारांश

प्रस्तुत शोधपत्र में लेज्युनिऐसी कुल की छः नई जातियों जिनमें *कोलोलेज्युनिया खवांगलुंगेंसिस* सुशील के. सिंह, *कोलोलेज्युनिया मुर्लेनसिस* सुशील के. सिंह, *ड्रिपेनोलेज्युनिया मिजोरमेंसिस* सुशील के. सिंह, *लेज्युनिया बुकपुएंसिस* सुशील के. सिंह, *लेज्युनिया कोलासिबेंसिस* सुशील के. सिंह, *लेप्टोलेज्युनिया मिजोरमेंसिस* सुशील के. सिंह, एवं दो नवीन अंर्तजाति प्रभेदों *लेज्युनिया एफ्रिगाई* प्रभेद *इंडिका* सुशील के. सिंह, *स्प्रूसिऐंथस सेमीरेपेंडस* प्रभेद *इंडिकस* सुशील के. सिंह को पूर्वोत्तर भारत के मिजोरम राज्य से प्रलेखित कर वर्णित किया गया है।

ABSTRACT

Six new species namely *Cololejeunea khawanglungensis* Sushil K. Singh *sp. nov., Cololejeunea murlenensis* Sushil K. Singh *sp. nov., Drepanolejeunea mizoramensis* Sushil K. Singh *sp. nov., Lejeunea bukpuiensis* Sushil K. Singh *sp. nov., Lejeunea kolasibensis* Sushil K. Singh *sp. nov., Leptolejeunea mizoramnsis* Sushil K. Singh *sp. nov.,* and two new varieties namely *Lejeunea eifrigii* var. *indica* Sushil K. Singh *var. nov., Spruceanthus semirepandus* var. *indicus* Sushil K. Singh *var. nov.* belonging to family Lejeuneaceae have been described from Mizoram in North-East India.

Keywords: *Cololejeunea, Drepanolejeunea, Lejeunea, Leptolejeunea*, India, New Species, *Spruceanthus*

INTRODUCTION

Family Lejeuneaceae is one of the most prolific families among the leafy liverworts with predominantly corticolous and foliicolous populations. There are about 1000 species belonging nearly to 75 genera known across the globe, broadly categorised into two subfamilies, Ptychanthoideae with 18 genera and Lejeuneoideae with 57 genera (Gradstien, 2013; Söderström & al., 2016; Zhu & al. 2017, 2018; Zhu & Ye, 2018; Gradstein & al., 2018). High morphological diversity of gametophytic and sporophytic characters poses great difficulty in identification of this miniature plant group, perhaps one of the reasons many species are still undescribed and several others either misidentified or poorly described. To date, 235 taxa related to 24 genera are recognized from India under the family

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Lejeuneaceae (Singh & al., 2016; Kumar & Singh, 2016; Singh & Kumar, 2017; Majumdar & Dey, 2017; Manju & al., 2017).

In the framework of the liverwort and hornwort flora of Mizoram project, the author collected (between 2008–2012) thousands of specimens of family Lejeuneaceae. After careful examination of the morphological and anatomical characters of these specimens and study of pertinent literature, eight taxa have been found to be distinct from the existing ones in the family, hence theseare described here as new. Detailed taxonomic description and line drawing illustrations for each of them are provided.

TAXONOMIC DESCRIPTIONS

1. **Cololejeunea khawanglungensis** Sushil K. Singh, ***sp. nov.*** **[Fig. 1]**

Type: India, Mizoram, Lunglei, Khawanglung WLS, 23°09'8.7" N, 92°55'23.2" E, 714 m, 04.12.2012, S.K. Singh & Party 127760A (holo: ASSAM!).

Plants light – whitish green when fresh, yellowish green in herbarium; shoots 3 – 5 mm long, 1.0 – 1.2 mm wide including leaves, branching scarce, irregular, *Lejeunea*-type. Stem cross section suborbicular in outline, 40.0 – 72.5 µm, 3 cells across diameter; cortical cells 5, rectangular – subquadrate, 7.5 – 27.5 × 5.0 – 20.0 µm; medullary cell 1, polygonal, 15.0 – 25.0 × 10.0 – 17.5 µm; ventral merophyte 1 cell wide. Leaves imbricate, obliquely spreading; leaf lobes ovate – suorbicular, 0.62 – 0.70 mm long, 0.52 – 0.57 mm wide, apex rounded, margin entire, antical margin arched, postical margin nearly straight to slightly arched, bordered by hyaline cells in 2 – 3 (-5) rows present 3/4 part of both; marginal hyaline leaf cells towards apex subquadrate – rectangular, 12.5 – 35.0 × 5.0 – 15.0 µm; median leaf cells hexagonal, 17.5 – 40.0 × 10.0 – 22.5 µm; basal leaf cells elongated, polygonal, 15.0 – 65.0 × 12.5 – 30.0 µm; cells with small trigones (much prominent in basal cells), intermediate thickenings present in basal cells only; cells dorsally papillose, papillae one per cell, small, 3 – 5 µm in diameter; vitta composed of 3 – 4 rows each with 3 – 5 linear oblong ocelli; leaf lobules inflated, ovate – suborbicular, 1/3 as long as the lobe, bidentate, first tooth 2 cells long, 1 cell wide at base, second tooth 1 cell long, hyaline papilla present on the inner surface of first tooth base, keel arched, papillose; stylus 1-celled. Rhizoids numerous, fasciculate, hyaline. Androecial and gynoecial branches ont observed.

Habitat: Foliicolous, growing in association with *Leptolejeunea* sp., in moist and shaded place at elevation of about 700 m asl.

Distribution: India (Mizoram), probably endemic.

Note: In having hyaline leaf margin and vita cells, this species belongs to subgenus *Taenioolejeunea*. *Cololejeunea khawanglungensis* is easily distinguishable from other species under the subgenus by its ovate – suorbicular leaf lobes with the margins bordered by 2 – 3 (-5) rows of hyaline cells present 3/4 part, leaf cells having vitta composed of 3 – 4 rows each with 3 – 5 linear oblong ocelli, ovate – suborbicular leaf lobules which are 1/3 as long as lobe, bidentate, first tooth 2 cells long, 1 cell wide at base, second tooth 1 cell long, arched and papillose keel. It resembles *C. inflata* Steph. and *C. yipii* R.L. Zhu, but it can be easily distinguished from them. *C. inflata* differs in having large ovate leaf lobules which are 2/5 – 1/2 as long as leaf lobe with 2 cells long first tooth, 1 – 3 cells long second tooth and smooth keel, leaf cells with vitta in 1 – 3 rows having 4 – 6 ocelii each and low papillosity (1.5 – 3.0 µm in diameter), while *C. yipii* can be distinguished by its oblong-ovate leaf lobes with finely denticulate margin, and ovate leaf lobules with 2 cells long first tooth and 3 – 5 cells long second tooth (Zhu & So, 2001).

2. Cololejeunea murlenensis Sushil K. Singh, ***sp. nov.*** **[Fig. 2]**

Type: India, Mizoram, Champhai, Murlen National Park, 23°38'32.7" N, 93°17'34" E, 1492 m, 19.02.2009, S.K. Singh & Party 120082B (holo: ASSAM!).

Plants pale yellow in herbarium; shoots 3 – 4 mm long, 0.52 – 0.62 mm wide including leaves, branching scarce, irregular, *Lejeunea*-type. Stem in cross section suborbicular in outline, 37.5 – 55.0 µm, 3 cells across the diameter; cortical cells 6 – 7, rectangular – polygonal, 10.0 – 22.5 × 7.5 – 17.5 µm; medullary cell 1, polygonal, 7.5 – 17.5 × 7.5 – 12.5 µm; ventral merophyte 1 – 2 cells wide. Leaves imbricate – rarely contiguous, obliquely – widely spreading; leaf lobes triangular-ovate, 0.21 – 0.46 mm long, 0.13 – 0.28 mm wide, margin spinose, antical margin convex, postical margin arched – nearly straight, apex acute – subacute, rarely obtuse; marginal leaf cells towards apex rectangular – subquadrate or polygonal, 7.5 – 10.0 × 5.0 – 7.5 µm; median leaf cells polygonal, 7.5 – 12.5 × 5.0 – 10.0 µm; basal leaf cells elongated, polygonal, 7.5 – 22.5

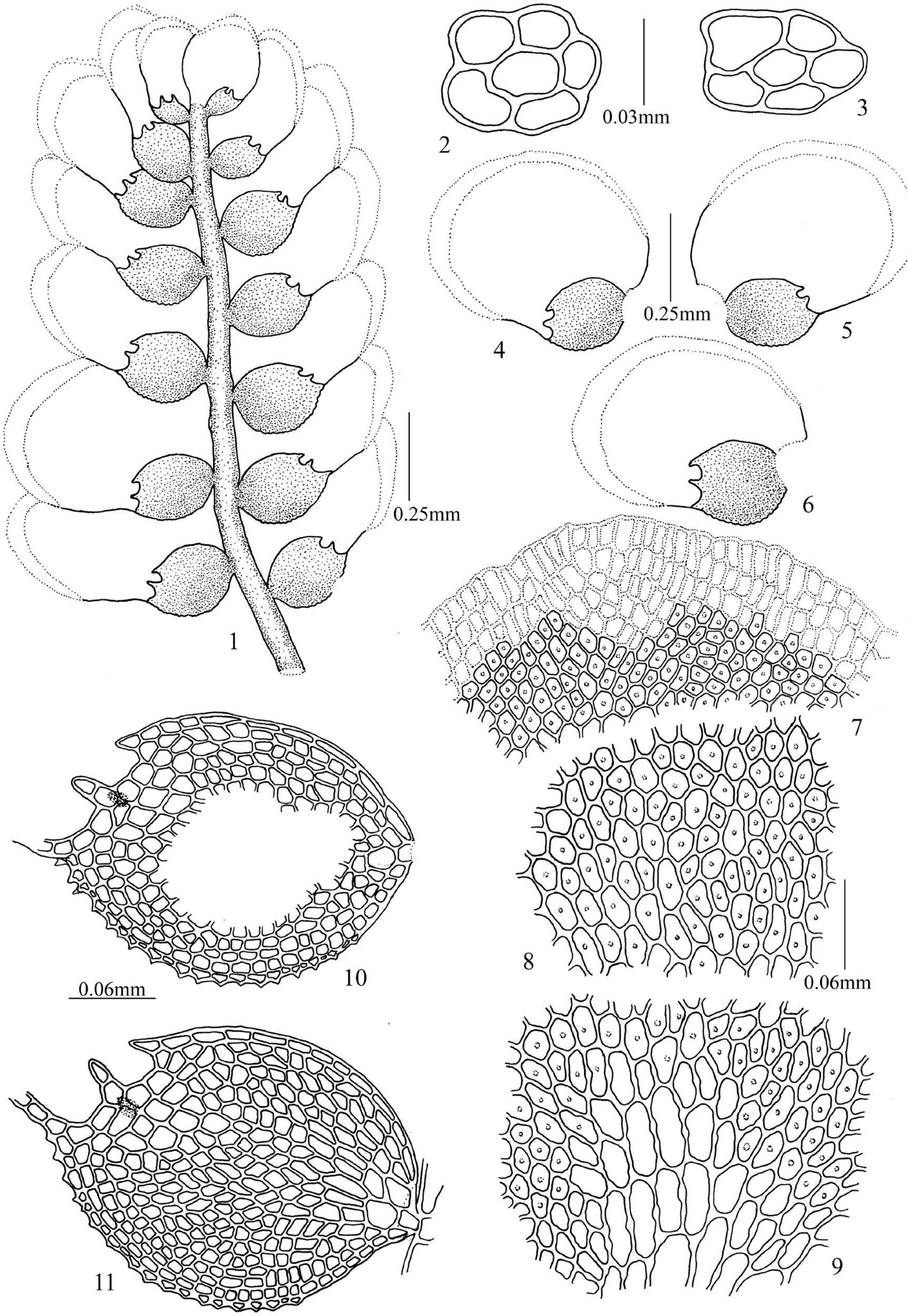

Fig. 1. *Cololejeunea khawanlungensis* Sushil K. Singh sp. nov.: **1.** A portion of plant in ventral view; **2-3.** Cross sections of stem; **4-6.** Leaves; **7.** Marginal leaf cells towards apex; **8.** Median leaf cells; **9.** Basal leaf cells; **10-11.** Leaf lobules.

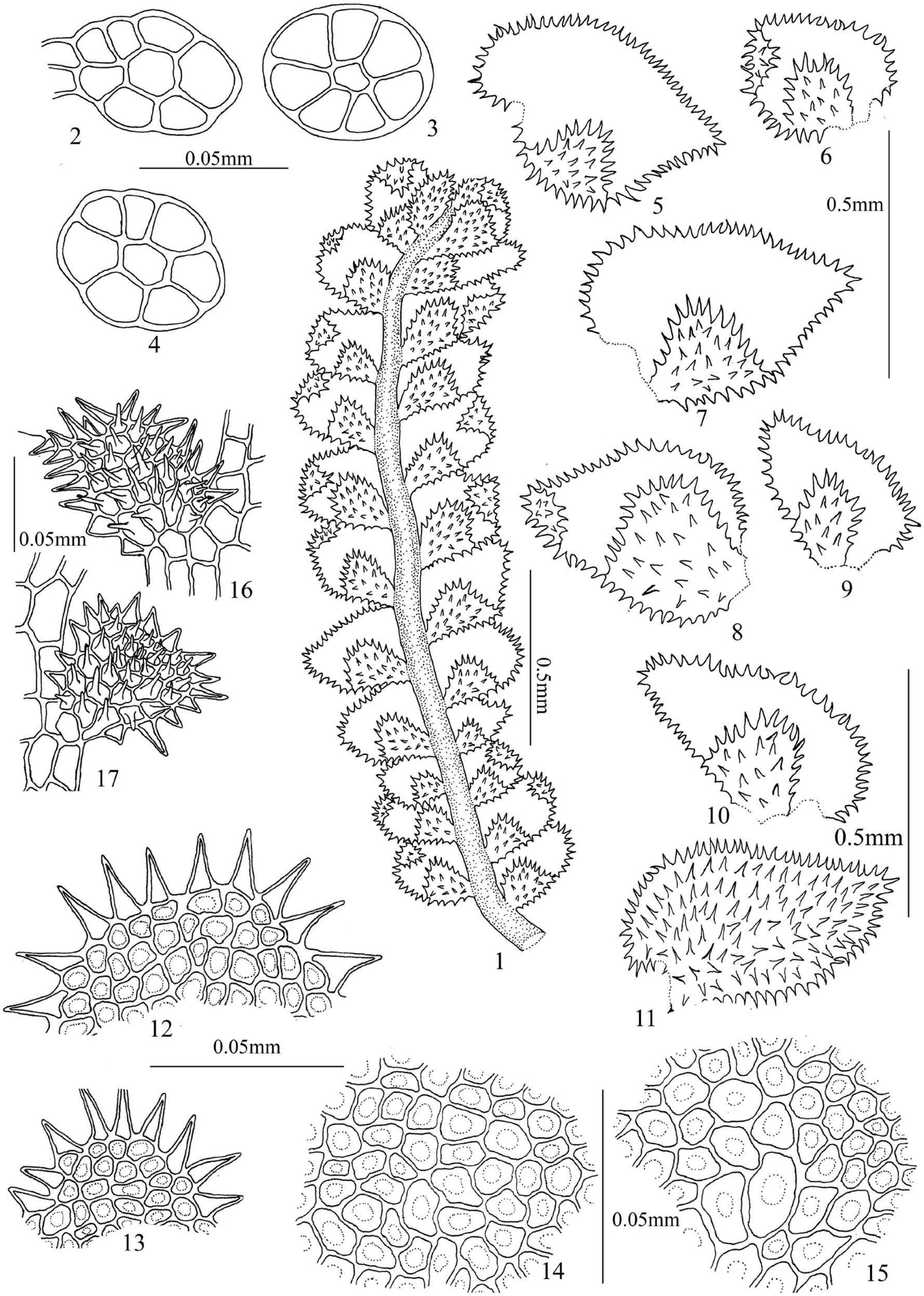

Fig. 2. *Cololejeunea murlensis* Sushil K. Singh sp. nov.: **1.** A portion of plant in ventral view; **2-4.** Cross sections of stem; **5-11.** Leaves; **12-13.** Marginal leaf cells towards apex; **14.** Median leaf cells; **15.** Basal leaf cells; **16-17.** Leaf lobules.

× 5.0 – 15.0 µm; cells with minute trigones (prominent in basal cells), intermediate thickenings lacking; leaf cells dorsally papillose, papillae spinose, one per cell, 7.5 – 12.5 × 3.75 – 5.0 µm; leaf lobules inflated, triangular-ovate, 1/2 as long as the lobe, covered with large spinose papillae, first tooth and second tooth obsolete, hyaline papilla invisible; stylus absent. Rhizoids fasciculate, few, hyaline. Androecial and gynoecial branches ont observed.

Habitat: Terricolous, in association with *Cyathodium* sp., *Lejeunea* sp., in moist place at elevation of about 1500 m asl.

Distribution: India (Mizoram), probably endemic.

Note: This new species belongs to subgenus *Cololejeunea* and is readily distinguishbale from other species under the subgenus in its triangular-ovate leaf lobule which is fully covered by large spinose papillae. *Colejeunea kodamae* Kamim. and *C. ornata* A. Evans resemble to the species, but both are distinct. *Colejeunea kodamae* differ in having partially spinose leaf lobule (papillae present only at distal part) with 2 – 3 cells long fist tooth and 1-celled second tooth, while *C. ornata* is distinguishable by its very large stylus (3 – 15-celled) and leaf lobule with 2 – 3 cells long fist tooth and 1-celled second tooth (Mizutani, 1986).

3. Drepanolejeunea mizoramensis Sushil K. Singh, ***sp.nov.*** **[Fig. 3]**

Type: India, Mizoram, Lawngtlai, Ngengpui WLS, 22°29'49.7" N, 92°46'33.1" E, 138 m, 01.12.2012, S.K. Singh & Party 127584A (holo: ASSAM!).

Plants pale yellow in herbarium; shoots 5 – 7 mm long, 0.37 – 0.56 mm wide including leaves, irregularly branched, branching *Lejeunea*-type. Stem in cross section orbicular – suborbicular in outline, 27.5 – 35.0 × 22.5 – 30.0 µm, 4 cells acoss diameter; cortical cells 7, quadrate – subquadrate or rectangular, 7.5 – 15.0 × 5.0 – 10.0 µm, slightly thick-walled; medullary cells 3 – 4, quadrate – subquadrate or rectangular, 5.0 – 10.0 × 5.0 – 7.5 µm, slightly thick-walled. Leaves remote, obliquely spreading; leaf lobe triangular-ovate – ovate, 0.15 – 0.20 mm long, 0.08 – 0.11 mm wide, margin feebly denticulate, antical margin slightly arched, postical margin arched, apex acute – obtuse; marginal leaf cells towards apex quadrate – subquadrate or triangulate or sometimes rectangular, 5.0 – 10.0 × 5.0 – 7.5 µm; median leaf cells subquadrate – hexagonal or occasionally rectangular or polygonal, 10.0 – 15.0 × 7.5 – 10.0 µm; basal leaf cells hexagonal – polygonal, 10.0 – 25.0 × 5.0 – 12.5 µm; cells with dorsal papillae, trigones and intermediate nodular thickenings absent; ocelli 1 – 4, irregularly scattered, the basal one 12.5 – 25.0 × 10.0 – 17.5 µm; leaf lobule ovate – subqudrate or sometimes reduced, well developed ones 1/3 – 1/2 of lobe length, 0.06 – 0.12 mm long, 0.05 – 0.08 mm wide, free margin bordered by 6 – 8 quadrate – subqudrate – rectangular cells, bidentate, first tooth large, 1-celled, curved, occasionally indistinct, second tooth always indistinct, hyaline papilla present at proximal side of first tooth. Underleaves remote, transeversally inserted, 0.05 – 0.07 mm long, 0.07 – 0.10 mm wide, bilobed to 1/2 – 2/3 of its length, lobes linear-lanceolate, nearly horizontally spreading, 2 – 3 (-4) cells long, 1 – 2 cells wide at base, margin entire. Dioicous. Androecia not found. Gynoecia on short lateral branch, with 1 subfloral innovation; bract lobes oblong, 0.15 – 0.17 mm long, 0.05 – 0.06 mm wide, apex obtuse or shallowly truncate, margin entire; bract lobule oblong – ovate, 0.14 – 0.16 mm long, 0.03 – 0.05 mm wide, apex rounded, margin entire; bracteole oblong – obovate, 0.18 – 0.20 mm long, 0.08 – 0.10 mm wide, bilobed to 1/3 – 1/5 of length, margin entire, apex subacute; perianth obovate, 0.40 – 0.60 mm long, 0.27 – 0.35 mm wide, 5-keeled (2 lateral, 2 ventral and 1 dorsal), keels horizontally spreading horn-like towards apex.

Habitat: Foliicolous, growing in association with other liverworts, in moist and shady place at lower elevation.

Distribution: India (Mizoram), probably endemic.

Note: This species is closely related to *D. vesiculosa* (Mitt.) Steph., but the latter differs by its much wider underleaf lobes which are 2 – 4 cells wide at base and leaflobes are caducous and leaf bases possess 1 – 2 ocelli. It also shows similaity with *D. angustifolia* (Mitt.) Grolle in general appearance of plants and underleaf structure and cellular network. However, the latter differs from the former in having subacute – acute or long acuminate leaf lobe apices and 1 – 2 ocelli per leaf lobe (see Udar & Awasthi, 1982).

4. Lejeunea bukpuiensis Sushil K. Singh, ***sp.nov.*** **[Fig. 4]**

Type: India, Mizoram, Kolasib, Bukpui forest, 24°04'14" N, 92°47'22" E, 945 m, 05.12.2010, S.K. Singh & Party 120517 (holo: ASSAM!).

Plants light green when fresh, yellowish green in herbarium; shoots 10 – 18 mm long, 1.2 – 1.8 mm wide including leaves, branching irregular, *Lejeunea*-type. Stem in cross section oval – elliptical in outline, 95.0 – 122.5 × 75.5 – 87.5 µm, 6 – 9 cells across the diameter; cortical cells 7 (-8), subquadrate – rectangular, 20.0 – 42.5 × 15.0 – 30.0 µm, thin-walled; medullary cells 17

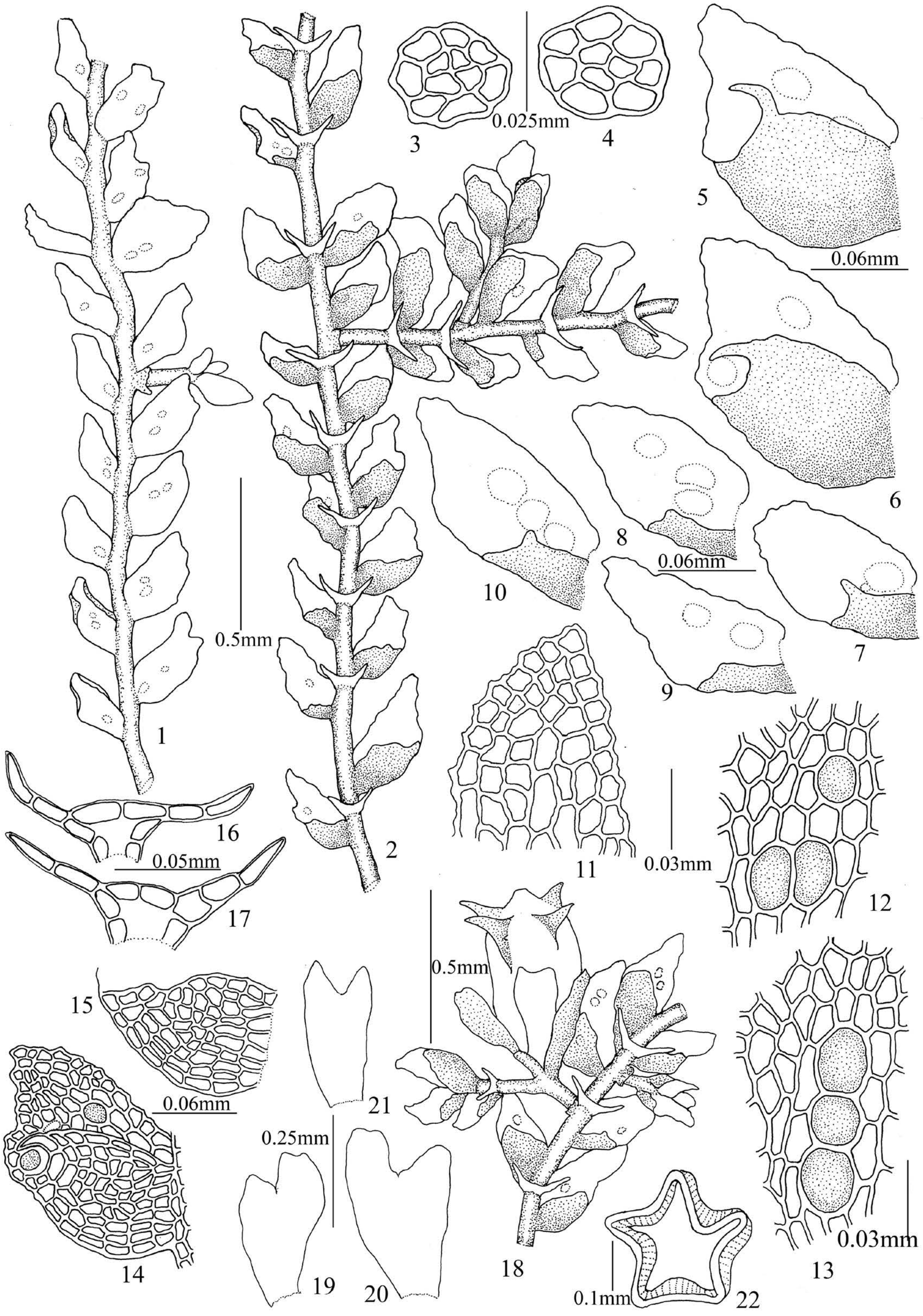

Fig. 3. *Drepanolejeunea mizoramensis* Sushil K. Singh sp. nov.: **1.** A portion of plant in dorsal view; **2.** A portion of plant in ventral view; **3-4.** Cross sections of stem; **5-10.** Leaves; **11.** Marginal leaf cells towards apex; **12.** Median leaf cells; **13.** Basal leaf cells; **14.** A leaf lobe with lobule; **15.** A leaf lobule; **16-17.** Underleaves; **18.** A portion of plant with perianth; **19-20.** Female bracts; **21.** A female bracteole; 22. Cross section of perianth.

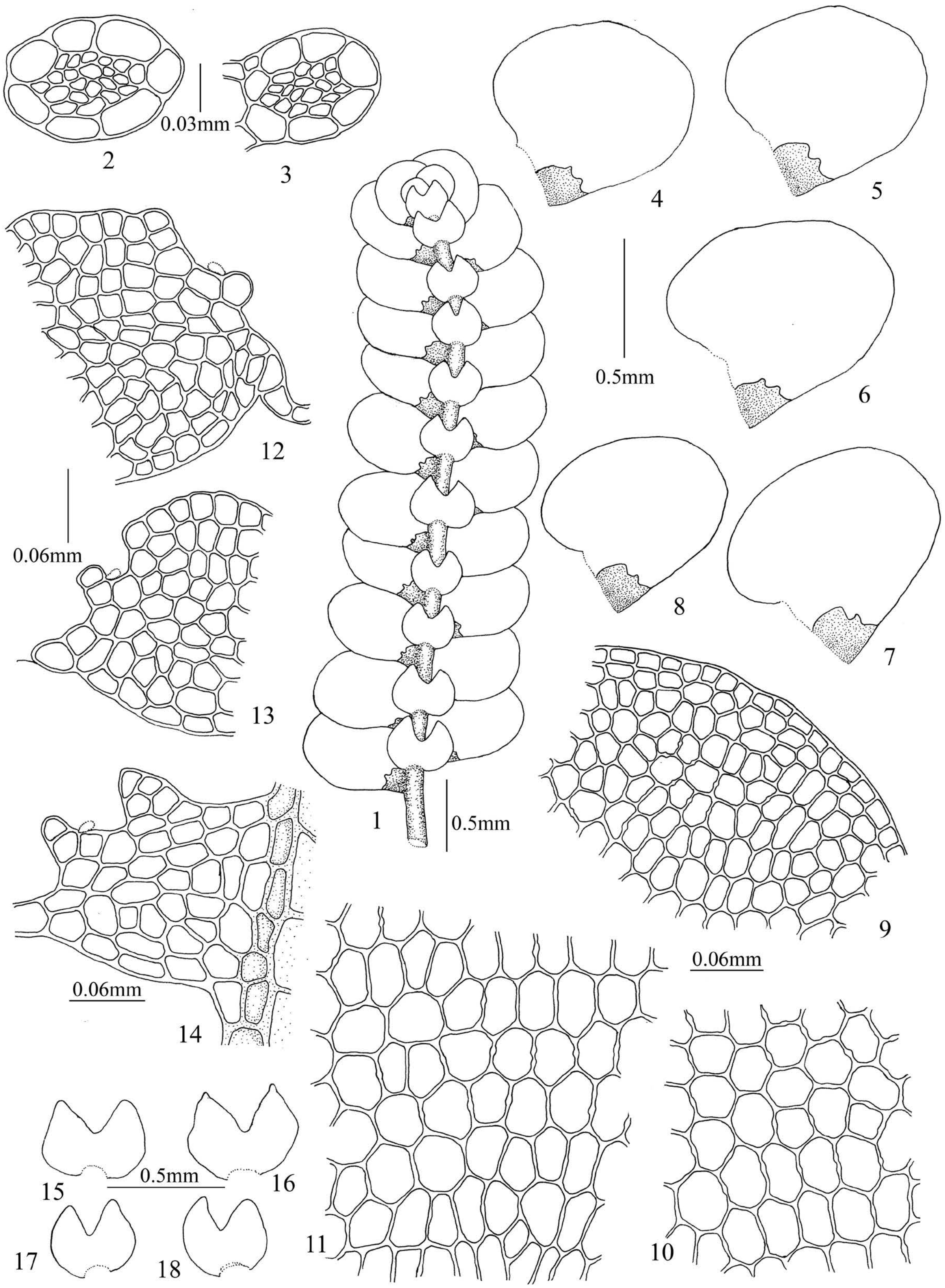

Fig. 4. *Lejeunea bukpuensis* Sushil K. Singh sp. nov.: **1.** A portion of plant in ventral view; **2-3.** Cross sections of stem; **4-8.** Leaves; **9.** Marginal leaf cells towards apex; **10.** Median leaf cells; **11.** Basal leaf cells; **12-14.** Leaf lobules; **15-18.** Underleaves.

– 22, smaller, 7.5 – 20.0 × 5.0 – 10.0 µm, thin-walled. Leaves imbricate, widely spreading; leaf lobe almost suborbicular, 0.65 – 0.90 mm long, 0.62 – 0.80 mm wide, antical margin convex, postical margin nearly straight, apex rounded; marginal leaf cells towards apex quadrate – subquadrate – rectangular, 14.0 – 17.5 × 7.5 – 15.0 µm; median leaf cellshexagonal, 30.0 – 52.5 × 20.0 – 37.5 µm; basal leaf cells slightly elongated, hexagonal, 35.0 – 62.5 × 15.0 – 42.5 µm; cells with smaller trigones, intermediate thickenings frequently present; cuticle smooth; leaf lobule c. 1/4 as long as the lobe, slightly inflated, rectangular oroblong-ovate, 0.15 – 0.19 mm long, 0.16 – 0.24 mm wide, bidentate; first tooth 1 – 3 cells long, 1 – 2 cells wide at base; second tooth prominent, 1 – 3 cells long 1 – 2 cells wide at base; hyaline papilla at the proximal side of first tooth; keel nearly straight, smooth. Underleaves distant, reniform, 3 – 4 times as wide as the stem, 0.25 – 0.37 mm long, 0.36 – 0.50 mm wide, slightly wider than long, bilobed to 1/2 of underleaf length, margin entire, sinus narrow – wide. Rhizoids numerous, fasciculate at the base of underleaves. Androecial and gynoecial branches ont observed.

Habitat: Foliicolous, growing in pure population or in association with other liverworts, in moist and shady places at elevation of c. 950 m asl.

Distribution: India (Mizoram), probably endemic.

Other specimens examined: Mizoram, Kolasib, Bukpui forest, 24°04’14” N, 92°47’22” E, 945 m asl, 05.12.2010, S.K. Singh & Party 120518, 120519, 120523, 120524, 120525, 120526A, 120527, 120528, 120529, 120530A, 120532, 120533A, 120534 (paratypes: ASSAM!).

Notes: This species resembles morphologically with *Lejeunea kashyapii* M.Dey, D.K.Singh & D.Singh – a species described from Sikkim, India (Dey & al., 2008). However, it distinctly differ from the latter in having prominent 1 – 3 cells long 1 –2 cells wide second tooth in leaf lobule and leaf lobe cells with prominent intermediate thickenings, comparatively larger underleaves (0.36 – 0.50 mm wide, 3 – 4 times as wide as the stem), greater number of medullary cells (17 – 22) in stem. Whereas, in *Lejeunea kashyapii* second tooth in leaf lobule is indistinct, leaf lobe cells are without intermediate thickenings, underleaves are comparatively narrower (0.28 – 0.37 mm wide, 2 – 3 times as wide as the stem), lesser number of medullary cells (12 – 16) in stem (see Dey & Singh, 2012).

5. Lejeunea eifrigii var. indica Sushil K. Singh, *var. nov.*

[Fig. 5]

Type: India, Mizoram, Kolasib, Bukpui forest, 24°04’47” N, 92°47’2” E, 900 m, 07.12.2010, S.K. Singh & Party 120612 (holo: ASSAM!).

Plants light green when fresh, yellowish green in herbarium; shoots 10 – 14 mm long, 1.0 – 1.4 mm wide including leaves, branching irregular, *Lejeunea*-type. Stem in cross section oval– suborbicular in outline, 82.5 – 92.5 × 70.0 – 75.0 µm, 5 – 6 cells across diameter; cortical cells 7 (-8), rectangular – polygonal, 20.0 – 42.5 × 15.0 – 37.5 µm, thin-walled; medullary cells 7 – 11, subquadrate – polygonal, 7.5 – 22.5 × 5.0 – 15.0 µm, thin-walled. Leaves imbricate – contiguous, widely spreading; leaf lobes ovate – triangular-ovate, 0.55 – 0.66 mm long, 0.47 – 0.59 mm wide, margin entire, antical margin strongly arched, postical margin slightly arched, apex usually obtuse – subacute or sometimes rounded; marginal leaf cells towards apex subquadrate – quadrate – rectangular, 12.5 – 32.5 × 7.5 – 25.0 µm; median leaf cells hexagonal, 30.0 – 47.5 × 20.0 – 27.5 µm; basal leaf cells slightly elongated, hexagonal, 37.5 – 65.0 × 20.0 – 32.5 µm; cells with small triradiate – subnodulose trigones, intermediate thickenings present; cuticle smooth; leaf lobule inflated, small, 1/6 – 1/5 as long as the leaf lobe, sometimes strongly reduced, rectangular, 0.11 – 0.15 mm long, 0.10 – 0.13 mm wide, bidentate, first tooth small, unicellular, second tooth indistinct, hyaline papilla at proximal side of the first tooth; keel nearly straight – slightly arched. Underleaves distant, c. 2 times as wide as stem, reniform, 0.14 – 0.22 mm long, 0.14 – 0.25 mm wide, usually slightly wider than long, bilobed to 1/2 of underleaf length, margin entire, sinus narrow – wide. Rhizoids few, fasciculate at the base of underleaves. Androecial and gynoecial branches ont observed.

Habitat: Foliicolous, growing on fern fronds in moist and sheltered place at elevation of c. 900 masl.

Distribution: India (Mizoram), probably endemic.

Note: This new variety differs from the typical variety in having leaf lobe cells with triradiate – subnodulose trigones, prominent intermediate thickenings and ovate – triangular-ovate leaf lobes with usually obtuse – subacute apices (see Dey & Singh, 2012; Zhu & So, 2001).

6. Lejeunea kolasibensis Sushil K. Singh, *sp. nov.*

[Figs. 6, 7]

Type: India, Mizoram, Kolasib, Bukpui forest, 24°04’51.1” N, 92°47’37.3” E, 894 m, 06.12.2010, S.K. Singh & Party 120540 (holo: ASSAM!).

Plants light green when fresh, pale yellow in herbarium; shoots 13 – 16 mm long, 1.0 – 1.3 mm wide including

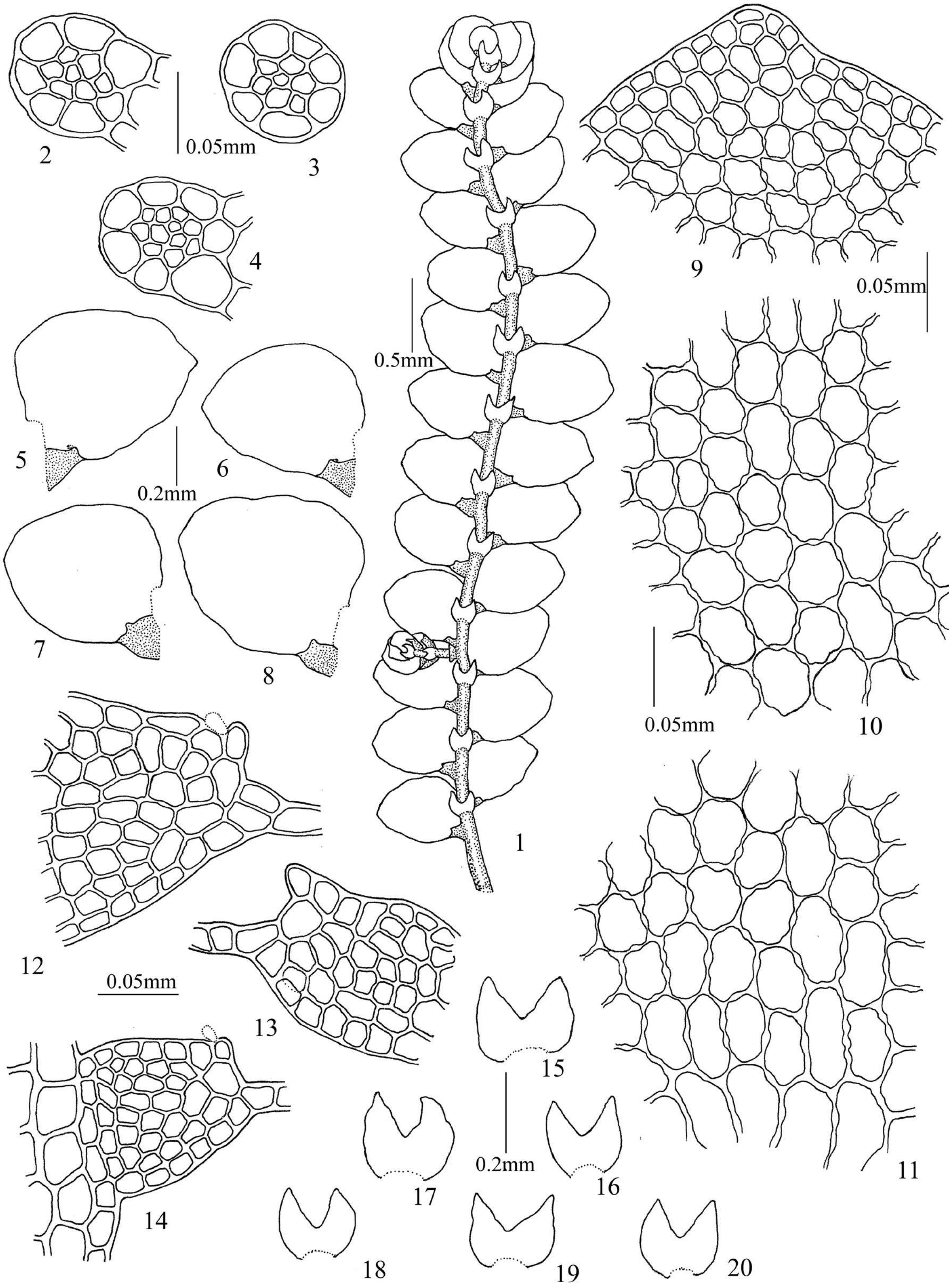

Fig. 5. *Lejeunea eifrigii* var. *indica* Sushil K. Singh var. nov.: **1.** A portion of plant in ventral view; **2-4.** Cross sections of stem; **5-8.** Leaves; **9-11.** Marginal leaf cells towards apex; **10.** Median leaf cells; **11.** Basal leaf cells; **12-14.** Leaf lobules; **15-20.** Underleaves.

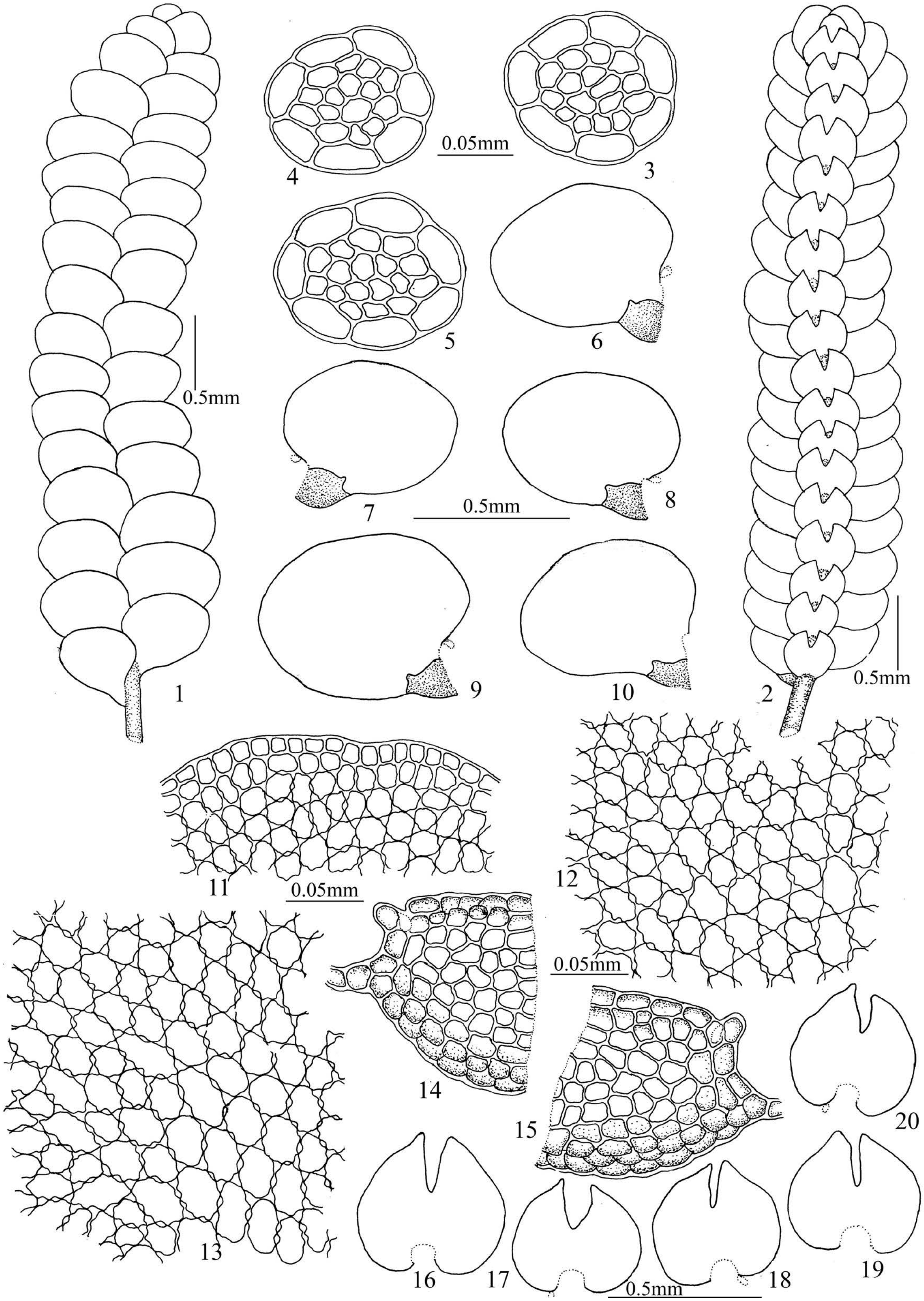

Fig. 6. *Lejeunea kolasibensis* Sushil K. Singh sp. nov.: **1.** A portion of plant in dorsal view; **2.** The same in ventral view; Cross sections of stem; **6-10.** Leaves; **11.** Marginal leaf cells towards apex; **12.** Median leaf cells; **13.** Basal leaf cells; **14-15.** Leaf lobules; **16-20.** Underleaves.

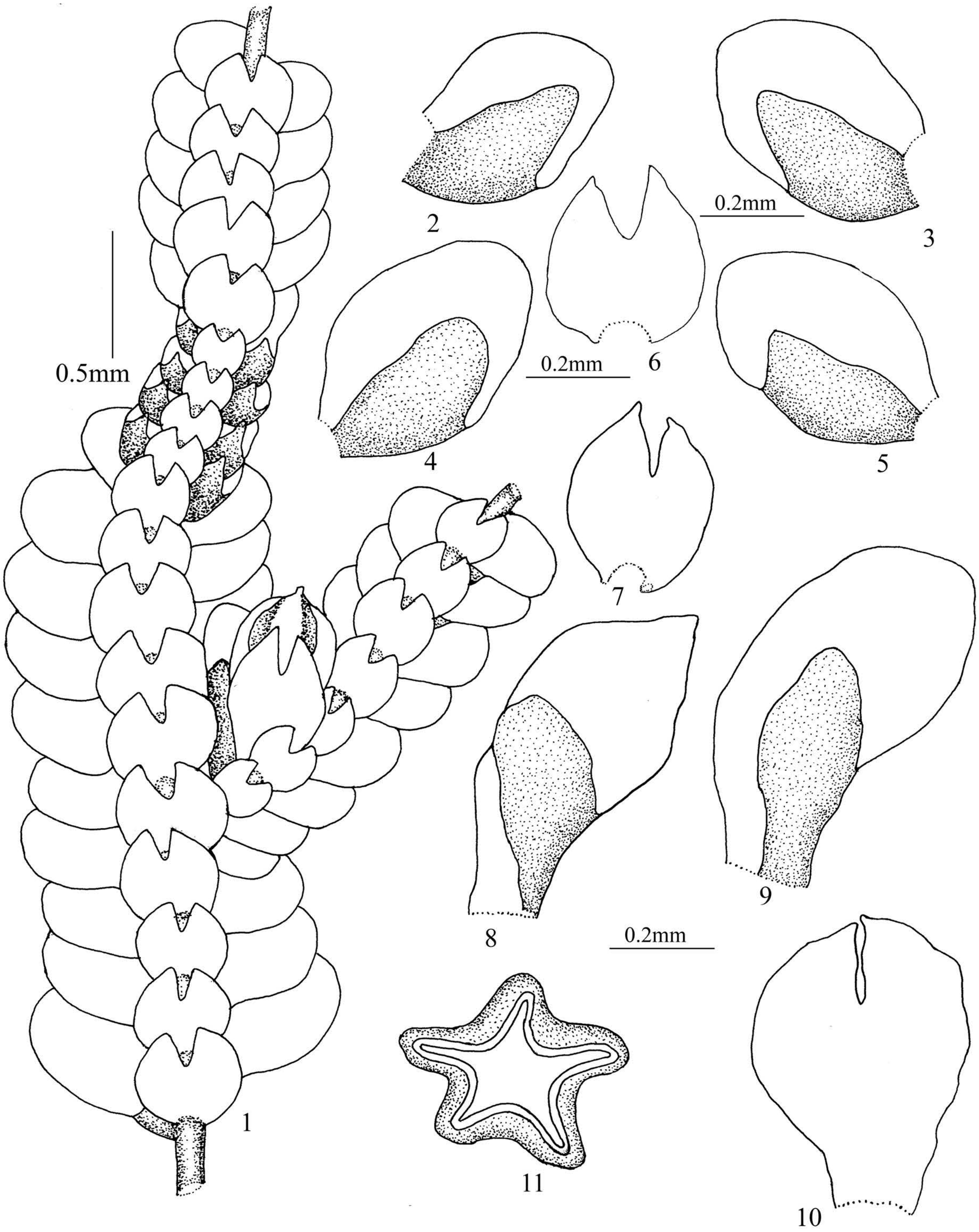

Fig. 7. *Lejeunea kolasibensis* Sushil K. Singh sp. nov.: **1.** A portion of monoicous plant in ventral view; **2-5.** Male bracts; **6-7.** Male bracteoles; **8-9.** Female bracts; **10.** A female bracteole; **11.** Cross section of perianth.

leaves, branching frequent, irregular, *Lejeunea*-type. Stem in cross section suborbicular in outline, 112.5 – 127.5 × 100.0 – 117.5 µm, 6 – 8 cells across diameter; cortical cells 7, rectangular, 30.0 – 52.5 × 17.5 – 22.5 µm, thin-walled; medullary cells 15 – 18, subquadrate – polygonal, 12.5 – 25.0 × 7.5 – 20.0 µm, thin-walled. Leaves imbricate, obliquely – widely spreading; leaf lobes ovate – suborbicular, 0.45 – 0.62 mm long, 0.45 – 0.55 mm wide, margin entire, often with hyaline papilla at base, antical margin strongly arched, postical margin nearly staright – slightly arched, apex rounded; marginal leaf cells towards apex quadrate – subquadrate or rectangular, 10.0 – 17.5 × 5.0 – 12.5 µm; median leaf cells hexagonal – polygonal, 20.0 – 40.0 × 15.0 – 25.0 µm; basal leaf cells hexagonal – polygonal, 22.5 – 47.5 × 15.0 – 27.5 µm; cells with prominent nodulose trigones and intermediate thickenings; cuticle smooth – finely verrucose; leaf lobules inflated, c. 1/4 – 1/3 as long as leaf lobe, ovate, 0.13 – 0.16 mm long, 0.10 – 0.15 mm wide, distal margin highly recurved, bidentate, first tooth unicellular, second tooth obsolete, hyaline papilla at the proximal side of first tooth, bent downwards, not visible in surface view without dissection. Underleaves imbricate, reniform – suborbicular, 0.32 – 0.44 mm long, 0.38 – 0.45 (-50) mm wide, 4 – 5 times as wide as stem, covering almost 1/3 area of shoot, bilobed to 1/3 – 1/2 of underleaf length, base slightly cordate, often with hyaline papilla, margin entire, sinus narrow. Rhizoids numerous, fasciculate near the base of underleaves; rhizoidal disc absent. Autoicous. Androecia intercalary on main shoot or short lateral branch; bracts in 4 – 10 pairs, bracteoles present throughout. Gynoecia on short branches with 1 subfloral innovation; bracts in 1 pair, oblong-ovate; bract lobes 0.52 – 0.67 mm long, 0.30 – 0.35 mm wide, apex obtuse, margin entire; bract lobules oblong, 0.25 – 0.47 mm long, 0.14 – 0.19 mm wide, apex obtuse, margin entire – sinuate; bracteoles obovate, 0.51 – 0.56 mm long, 0.38 – 0.43 mm wide, bilobed to 1/3 of its length, lobes with acute apices, margin entire-undulate; perianth emergent, obovate, 0.75 – 0.82 mm long, 0.50 – 0.67 mm wide, short-beaked, 5-keeled, keels smooth.

Habitat: Saxicolous, growing on rock surface in moist and shady place at elevation of c. 900 m asl.

Distribution: India (Mizoram), probably endemic.

Note: This species is closely allied to *Lejeunea sordida* (Nees) Nees & Mont. but it differs from latter by its autoicous sexuality; reniform – suborbicular, deeply bilobed (up to half) underleaves covering almost 1/3 area of shoot; smaller leaf cells and perianth with smooth keels. Whereas, *Lejeunea sordida* has dioicous plants; reniform, shallowly bilobed (1/4 – 1/3) underleaves covering more than 1/2 the area of shoot; comparatively larger leaf cells and perianth is with mammilose keels (Dey & Singh, 2012; Lee, 2013). *L. kolasibensis* also resembles *Lajeunea flava* (Sw.) Nees in stem anatomy, cell morphology, underleaf shape, monoicous sexuality and perianth structure. However, latter differs from the former in having smaller leaf lobules (1/5 – 1/4 of the leaf lobe), narrower underlerleaves (3 – 4 times as wide as stem) covering almost 1/4 area of shoot; terminal androecia bearing 2 – 5 pairs of bracts, additional hyaline papilla present at base of leaf lobe, lobule and underleaf (see also Dey & Singh, 2012).

7. **Leptolejeunea mizoramensis** Sushil K. Singh, ***sp. nov*.** **[Fig. 8]**

Type: India, Mizoram, Kolasib, Pualreng WLS, 24°11'27" N, 92°44'28.3" E, 466 m, 10.12.2010, S.K. Singh & Party 120724B (holo: ASSAM!).

Plants delicate, whitish – pale yellowish green in herbarium; shoots 7 – 10 mm long, 0.6 – 0.8 mm wide including leaves, irregularly branched, branching *Lejeunea*-type. Stem in cross section orbicular – suborbicular in outline, 52.5 – 70.0 µm, 4 cells across diameter; cortical cells 7, quadrate – subqudrate or rectangular, 12.5 – 25.0 × 10.0 – 20.0 µm, thin-walled; medullary cells 3, subquadrate, 12.5 – 17.5 × 10.0 – 12.5 µm, thin-walled. Leaves imbricate, subtransversally spreading; lobes obovate, 0.35 – 0.42 × 0.22 – 0.30 mm, margin denticulate, antical margin arched, postical margin slightly arched – more or less straight, apex obtuse – subacute; marginal leaf cells towards apex quadrate – subquadrate, 12.5 – 25.0 × 10.0 – 17.5 µm; median leaf cells more or less isodiametric, 22.5 – 40.0 × 17.5 – 30.0 µm; basal leaf cells slightly elongated, 25.0 – 47.5 × 15.0 – 32.5 µm; cells with prominent nodulose trigones, intermediate thickenings present, 1 – 3 on each wall; cuticle smooth; ocelli usually 3 per leaf lobe, basal ocellus larger than median one, oval-elliptic, 72.5 – 80.0 × 40.0 – 45.0 µm; leaf lobules inflated, oblong-ovate, 1/3 of lobe length, 0.13 – 0.17 × 0.8 – 0.11 mm, free lateral margin with 2 teeth, first tooth 1(-2) cells long, second tooth obsolete, hyaline papilla present at proximal side of first tooth. Underleaves remote, suquadrangular, 0.08 – 0.12 × 0.11 – 0.13 mm, slightly wider than stem, bilobed to c. 1/2 of its length, lobes subparallel - divergent, obtuse, 2 – 3 cells long, 1 – 2 cells wide ad base, lamina surrounded by 6 subquadrate – rectangular cells. Androecial and gynoecial branches ont observed.

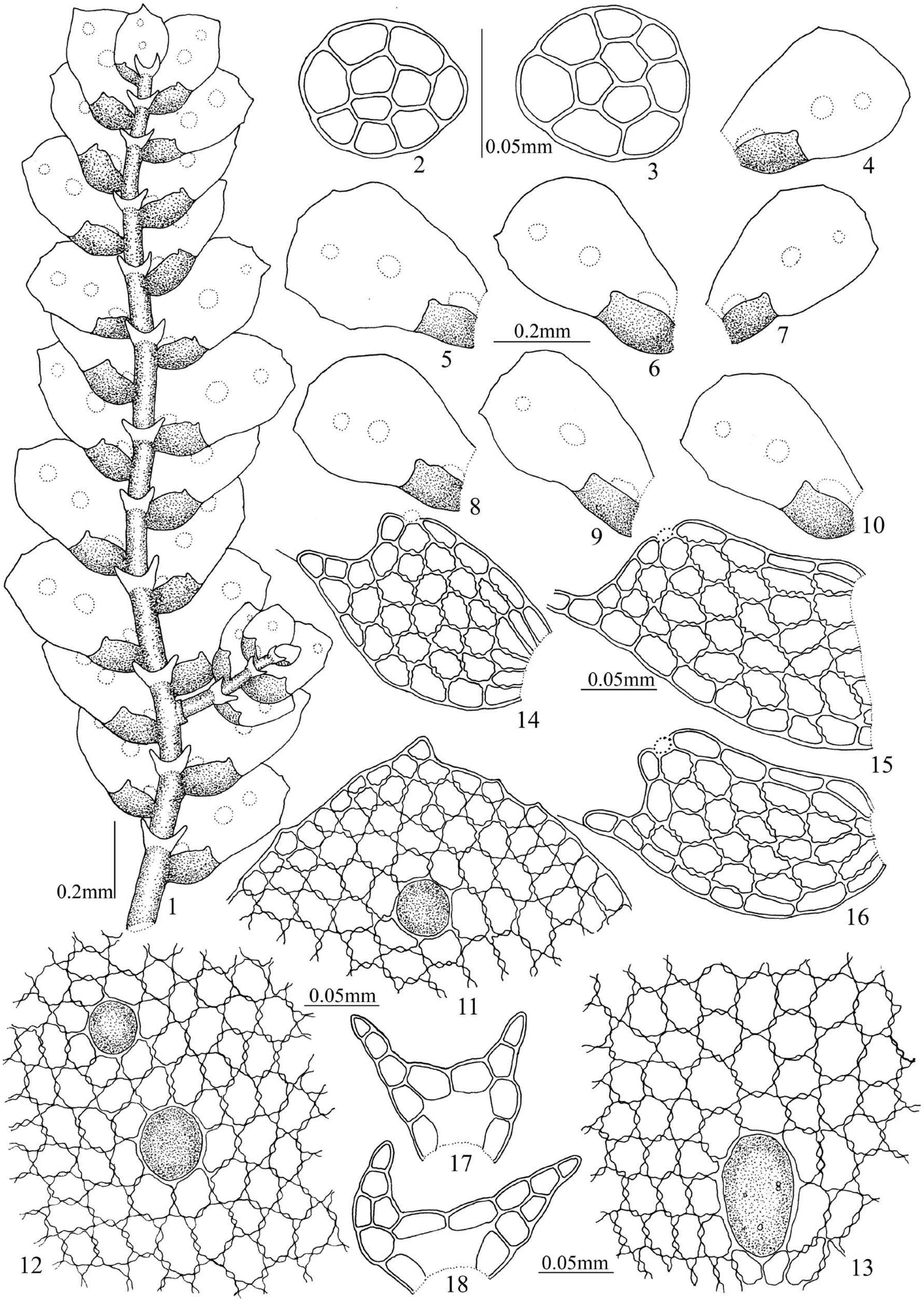

Fig. 8. *Leptolejeunea mizoramensis* Sushil K. Singh sp. nov.: **1.** A portion of plant in ventral view; **2-3.** Cross sections of stem; **4-10.** Leaves; **11.** Marginal leaf cells towards apex; **12.** Median leaf cells; **13.** Basal leaf cells; **14-16.** Leaf lobules; **17-18.** Underleaves.

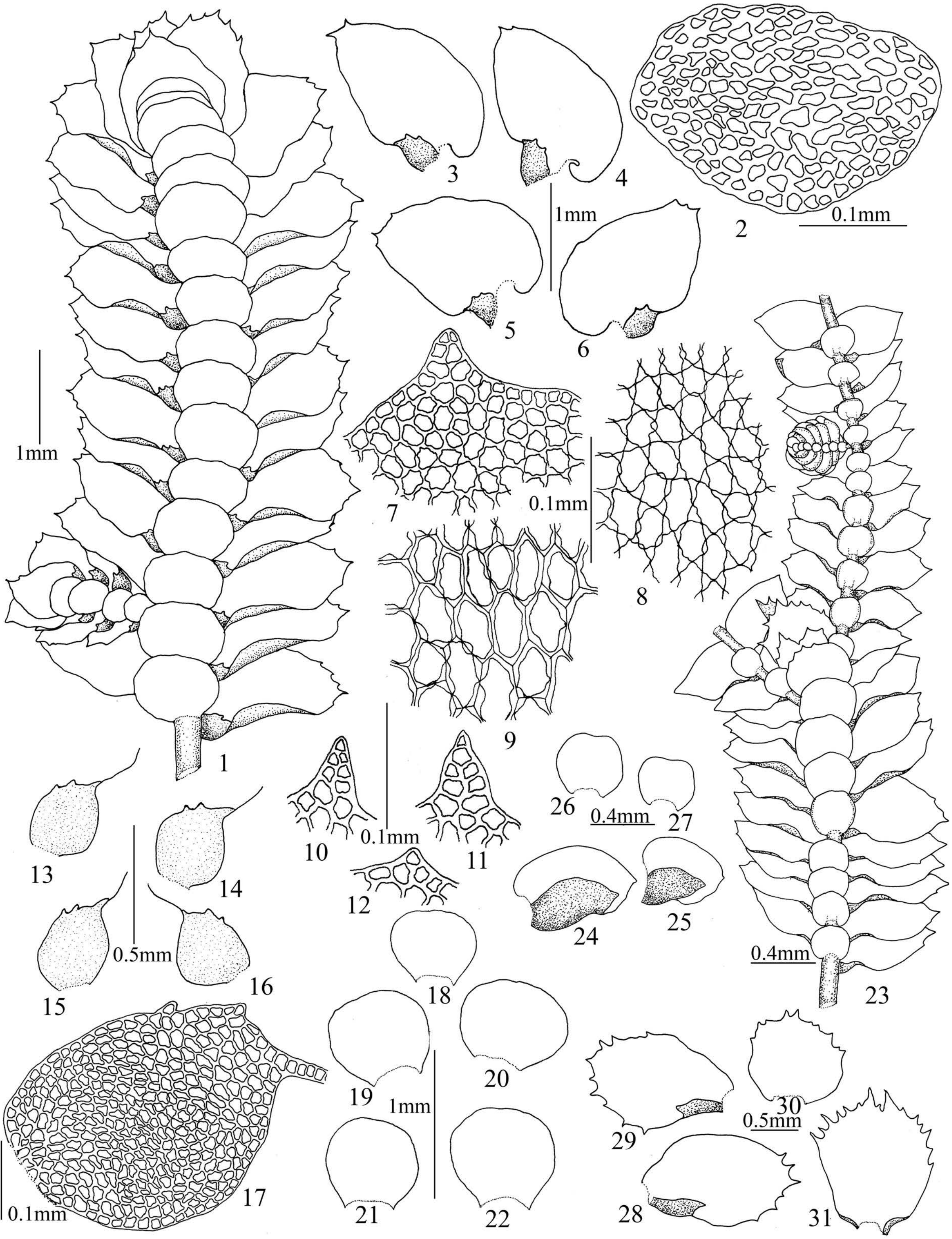

Fig. 9. *Spruceanthus semirepandus* var. *indicus* Sushil K. Singh var. nov.: **1.** A portion of plant in ventral view; **2.** Cross section of stem; **3-6.** Leaves; **7.** Marginal leaf cells towards apex; **8.** Median leaf cells; **9.** Basal leaf cells; **10-12.** Apical and marginal teeth; **13-17.** Leaf lobules; **18-22.** Underleaves; **23.** A portion of monoicous plant in ventral view; **24-25.** Male bracts; **26-27.** Male bracteoles; **28-29.** Female bracts; **30-31.** Female bracteoles.

Habitat: Foliicolous, growingin association with *Caudalejeunea* sp., *Cololejeunea* sp., in moist and shady places at elevation of 400 – 500 m asl.

Distribution: India (Mizoram), probably endemic.

Notes: Leeptolejeunea mizoramensis resembles *L. arunachalensis* Sudipa Das & D.K. Singh in habit, leaf lobe, underleaf morphology and stem anatomy. But, the latter differs in having usually 2 ocelli in leaf lobe, entire leaf margin with obtuse – subacute apex and larger leaf lobules which are 1/3 – 1/2 the lobe length (Das & Singh, 2008).

8. Spruceanthus semirepandus var. ***indicus*** Sushil K. Singh, ***var. nov.*** **[Fig. 9]**

Type: India, Mizoram, Lunglei, Khawanglung WLS, 23°09'21.8" N, 92°55'00.5" E, 721 m, 04.12.2012, S.K. Singh & Party 127726A (holo: ASSAM!).

Plant yellowish – brown; shoot 13 – 38 mm long, 2.75 – 3.25 mm wide including leaves, branching irregular, *Lejeunea* – type. Stem in cross section oval – elliptical in outline, 262.5 – 325.0 × 162.5 – 200.0 µm, 12 – 15 cells across the diameter; cortical cells in a single layer of 37 – 39 cells, quadrate – subqudrate or polygonal or traingular 7.5 – 32.5 × 5.0 – 22.5 µm, thick-walled; medullary cells subqudrate – polygonal or elongated rectangular, 12.5 – 35.0 × 10.0 – 25.0 µm, thick-walled. Leaves imbricate, obliquely – horizontally spreading; leaf lobes oblong – ovate, 0.87 – 1.50 mm long, 0.80 – 1.22 mm wide, margin entire – wavy, antical margin broadly convex, postical margin nearly straight, apex with (1-) 2– 3 (-5) tooth, teeth 2 – 5 cells long, 2 – 4 cells wide at base; marginal leaf cells towards apex subquadrate – polygonal, 10.0 – 30.0 × 5.0 – 20.0 µm; median leaf cells hexagonal – polygonal, 22.5 – 37.5 × 12.5 – 25.0 µm; basal cells slightly elongated, hexagonal – polygonal, 27.5 – 65.0 × 15.0 – 30.0 µm; cells with large nodulose, often confluent trigones, intermediate thickenings present; leaf lobule inflated ovate – suborbicular, 0.27 – 0.40 mm long, 0.21 – 0.30 mm wide, 1/4 – 1/3 as long as the lobe, free margin with 2 prominent teeth, 1 – 2 cells high, 2 – 3 cells wide at the base, apex obtuse, keel arched. Underleaves imbricate, 2 – 3 times as wide as stem, wider than long, suborbicular – reniform, (-0.32) 0.37 – 0.75 mm long, (0.42) 0.50 – 0.82 mm wide, margins entire, apex rotundate – truncate. Androecial and gynoecial branches ont observed.

Habitat: Corticolous, growing in association with *Cheilolejeunea* sp., in moist and shady place at elevation of about 700 m asl.

Distribution: India (Mizoram), probably endemic.

Note: Spruceanthus semirepandus var. *indicus* distinctly differs from the typical variety in having leaf lobes with fewer (1 – 5) teeth which are 1 – 4 cells long and 1 – 2 (-3) cells wide at base, the underleaves suborbicular – reniform with usually entire apices and undifferentiated stemin cross-section. In *S. semirepandus* var. *semirepandus* the leaf lobes are with 6 – 12 teeth, up to 9 cells long and to 6 cells wide at base; underleaves ovate with dentate apices and stem well differentiated into2-3-layered cortex and medulla (Udar & Awasthi, 1982b).

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